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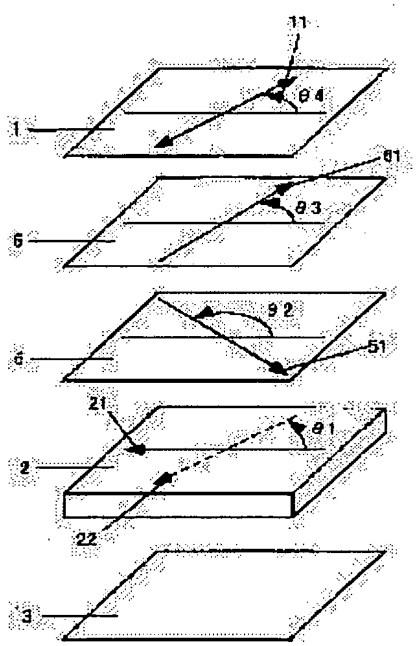
(71)Applicant : NIPPON MITSUBISHI OIL CORP

(72)Inventor : KAMISAKA TETSUYA
TOYOOKA TAKEHIRO

(54) REFLECTION LIQUID CRYSTAL DISPLAY DEVICE



(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a reflection liquid crystal display device having improved viewing angle characteristics and excellent visibility without decrease in the contrast characteristics or the like by disposing a compensating element including a specified liquid crystal film between a polarizing plate and a reflection plate.

SOLUTION: The display device is equipped with a polarizing plate 1, compensating element, liquid crystal cell 2 and reflection plate 3. As for the compensating element, preferably two compensating elements including a liquid crystal film in which nematic hybrid alignment with 5 to 35 average tilt angle is fixed are disposed between the polarizing plate 1 and the reflection plate 3. Further, a compensating element including a stretched film as well as the compensating elements 5, 6 including the aforementioned liquid crystal film can be used. Or, when the two compensating elements 5, 6 are arranged in the reflection type liquid crystal display device, each one or both of the elements may be disposed on the polarizing plate side and/or reflection plate side of the liquid crystal cell 2. The compensating elements used may have the same parameters or different parameters.

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[Claim(s)]
[Claim 1] The reflective mold liquid crystal display component which is equipped with a polarizing plate, a compensation component, a liquid crystal cell, and a reflecting plate, and is equipped with the compensation component containing the liquid crystallinity film which has been arranged between said polarizing plates and said reflecting plates, and fixed nematic hybrid orientation with an average tilt angle of 5 degrees - 35 degrees as said compensation component at least.
[Claim 2] A reflective mold liquid crystal display component [equipped with two compensation components which contain the liquid crystallinity film which fixed said nematic hybrid orientation as said compensation component] according to claim 1.
[Claim 3] The reflective mold liquid crystal display component according to claim 1 which is equipped with the compensation component containing an oriented film in addition to the compensation component which contains the liquid crystallinity film which fixed said nematic hybrid orientation as said compensation component.
[Claim 4] Said compensation component Two sheets are arranged between said polarizing plates and said liquid crystal cells at least, and it sets in the liquid crystal matter layer in the; aforementioned liquid crystal cell. A liquid crystal matter molecule angle of torsion accomplished toward the second field of the opposite side from the first field by the side of said compensation component theta 1, The product of refractive-index anisotropy **n1 of said liquid crystal matter molecule, and the thickness d1 of said liquid crystal matter layer among said compensation components of two sheets from the orientation shaft of said liquid crystal matter molecule by the side of the first [of **n1d1 and said liquid crystal matter layer / said] field the include angle to the lagging axis of the compensation component A of the direction near said liquid crystal cell theta 2, refractive-index anisotropy **n2 of said compensation component A, and said compensation component A A product with the thickness d2 of the film to constitute The include angle to the lagging axis of the compensation component B of the one distant from said liquid crystal cell among said compensation components of two sheets from the orientation shaft of said liquid crystal matter molecule by the side of the first [of **n2d2 and said liquid crystal matter layer / said] field theta 3, refractive-index anisotropy **n3 of said compensation component B, and said compensation component B If the include angle from an orientation shaft to the absorption shaft of said polarizing plate of said liquid crystal matter molecule by the side of the **n3d3 and first [of said liquid crystal matter layer / said] fields is set to theta 4, a product with the thickness d3 of the film to constitute The reflective mold liquid crystal display component of claim 1-3 given in any 1 term theta1-theta4 are satisfied with of the following type A1 or A2, and **n1d1, **n2d2, and **n3d3 are satisfied with of following type A3.
{theta -- 1= +40 degrees - +80 degrees theta 2= +80 degrees - +150 degrees theta -- 3= +30 degrees - +90 degrees and theta4=+100degree-+160degree} ... A1 -- {-- theta -- 1= +40 degrees - +80 degrees theta 2= +130 degrees - +190 degrees theta 3= 0 degree - +60 degrees and theta -- 4= 0-+60 degrees --} ... A2{**n -- 1d 1= 100-300nm **n2d2=100-200nm and **n3d3=200-350nm} ... A3 [claim 5] A reflective mold liquid crystal display component given in any 1 term of claims 1-4 said whose liquid crystal cells are in TN mode or HAN mode.
[Claim 6] The reflective mold liquid crystal display component of claim 1-5 which is a color reflective mold liquid crystal display component given in any 1 term.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] About a reflective mold liquid crystal display component, this invention can perform a still more detailed bright achromatic color display, and its contrast is high and it relates to the reflective mold liquid crystal display component by which the angle-of-visibility dependency was canceled.
[0002]
[Description of the Prior Art] In recent years, the application application of a liquid crystal display has

accomplished expansion from the calculator to the display of a word processor or a personal computer by marked improvement in the display engine performance by progress of a liquid crystal display technique. furthermore, the thin shape which a liquid crystal display has -- a light weight -- the expectation of the commercial-scene expansion as a display of a personal digital assistant device which can harness the description greatly is growing. It has been an important technical problem to hold down power consumption to eye backlash which is usually a dc-battery drive as a pocket mold application. Therefore, the reflective mold liquid crystal display with which consumption of power does not need to use a large back light for the liquid crystal display of a pocket mold application especially attracts attention because low-power-izing, thin-shape-izing, and lightweight-izing are possible.
[0003] As a conventional reflective mold liquid crystal display, it explains taking the case of T.Sonehara's and others (JAPAN DISPLAY, 192 (1989)) technique. As the technique concerned shows the mode concerned to drawing 1 , using the Twisted Nematic (TN) mode as a liquid crystal cell layer, twist orientation of the liquid crystal molecule is carried out within the liquid crystal cell layer with a certain fixed pre tilt angle on both substrates. Such a liquid crystal cell layer is pinched with the polarizing plate 1 and the reflecting plate 3, as shown in drawing 2 .
[0004] It is drawing 2 (a) about an optical property when outdoor daylight carries out incidence to the liquid crystal display of such a configuration perpendicularly, It is shown in (b). In drawing 2 (a), the outdoor daylight which passed the polarizing plate 1 turns into the linearly polarized light, and carries out incidence to the liquid crystal layer 2. If the amount of birefringences which the liquid crystal layer 2 has is a quadrant wavelength grade, the polarization condition of the light in front of a reflecting plate 3 will serve as the circular polarization of light (left-handed circularly-polarized light or right-handed circularly polarized light). When the circular polarization of light of this reverse sense that serves as the circular polarization of light of the reverse sense by reflecting this circular polarization of light on a reflecting plate 3 (the left-handed circularly-polarized light turns into the right-handed circularly polarized light, and the right-handed circularly polarized light turns into the left-handed circularly-polarized light.) passes the liquid crystal layer 2 again, outgoing radiation polarization turns into the linearly polarized light of bearing where the direction of the linearly polarized light at the time of incidence intersects perpendicularly, the linearly polarized light concerned cannot penetrate a polarizing plate 1, but a dark display will be obtained.
[0005] On the other hand, if an electrical potential difference is impressed to the liquid crystal cell layer 2 like drawing 2 (b), the amount of birefringences will fall, on a reflecting plate, it becomes elliptically polarized light or the linearly polarized light, light can pass a result and a polarizing plate now, and clear display will be obtained.
[0006] Moreover, in addition to the liquid crystal cell layer 2 in TN mode, as a conventional reflective mold liquid crystal display component, there are some which newly added the quadrant wavelength plate 4 like drawing 3 . In this case, when an electrical potential difference is impressed and the amount of birefringences of the liquid crystal cell layer 2 is set to about 0 like drawing 3 (b), in order that the quadrant wavelength plate 4 may make the incidence linearly polarized light the circular polarization of light, a dark display as well as said explanation will be obtained. Moreover, an electrical potential difference is lowered like drawing 3 (a), the amount of birefringences of the liquid crystal cell layer 2 is changed, and clear display is obtained when the amount of birefringences of the liquid crystal cell layer 2 becomes equal to quadrant wavelength. At this time, the amount of birefringences of the sum total of the liquid crystal cell layer 2 and the quadrant wavelength plate 4 serves as the half-wave length, and the linearly polarized light at the time of incidence turns into the linearly polarized light which intersected perpendicularly just before a reflecting plate 3. Since after reflection is reflected with the linearly polarized light, a half-wave length part phase shifts again, it becomes the linearly polarized light parallel to the time of incidence at the time of outgoing radiation, and it serves as clear display.
[0007] However, in order that these reflective mold liquid crystal display component may usually use outdoor daylight, such as indoor light or outdoor light, since the direction of incidence of light has many cases from slant, an actual beam-of-light path becomes a thing like drawing 4 . However, even if it designs so that it may have a quadrant wavelength grade at the time of vertical incidence in order to obtain a dark display since it has angular dependence, if whenever [incident angle] changes, a gap will produce the amount of birefringences of the liquid crystal cell layer 2 from quadrant wavelength. Therefore, the light to which it went and came back cannot return to the linearly polarized light completely, but the technical problem that a perfect black display cannot be obtained occurs. Since phase contrast changes depending on the incident angle of light also when a quadrant wavelength plate is furthermore used, the same problem arises and the technical problem that contrast falls with an angle of visibility is left behind.
[0008]

[Problem(s) to be Solved by the Invention] The purpose of this invention has high contrast, and is to offer the reflective mold liquid crystal display component by which the angle-of-visibility dependency was canceled.
[0009]
[Means for Solving the Problem] According to this invention, the reflective mold liquid crystal display component which is equipped with a polarizing plate, a compensation component, a liquid crystal cell, and a reflecting plate, and is equipped with the compensation component containing the liquid crystallinity film which has been arranged between said polarizing plates and said reflecting plates, and fixed nematic hybrid orientation with an average tilt angle of 5 degrees - 35 degrees as said compensation component at least is offered.
[0010] Moreover, according to this invention, said reflective mold liquid crystal display component equipped with two compensation components which contain the liquid crystallinity film which fixed said nematic hybrid orientation as said compensation component is offered.
[0011] Furthermore, according to this invention, in addition to the compensation component which contains the liquid crystallinity film which fixed said nematic hybrid orientation as said compensation component, said reflective mold liquid crystal display component equipped with the compensation component containing an oriented film is offered.
[0012] According to this invention, furthermore, said compensation component Two sheets are arranged between said polarizing plates and said liquid crystal cells at least, and it sets in the liquid crystal matter layer in the; aforementioned liquid crystal cell. A liquid crystal matter molecule angle of torsion accomplished toward the second field of the opposite side from the first field by the side of said compensation component theta 1, The product of refractive-index anisotropy **n1 of said liquid crystal matter molecule, and the thickness d1 of said liquid crystal matter layer among said compensation components of two sheets from the orientation shaft of said liquid crystal matter molecule by the side of the first [of **n1d1 and said liquid crystal matter layer / said] field the include angle to the lagging axis of the compensation component A of the direction near said liquid crystal cell theta 2, refractive-index anisotropy **n2 of said compensation component A, and said compensation component A A product with the thickness d2 of the film to constitute The include angle to the lagging axis of the compensation component B of the one distant from said liquid crystal cell among said compensation components of two sheets from the orientation shaft of said liquid crystal matter molecule by the side of the first [of **n2d2 and said liquid crystal matter layer / said] field theta 3, refractive-index anisotropy **n3 of said compensation component B, and said compensation component B If the include angle from an orientation shaft to the absorption shaft of said polarizing plate of said liquid crystal matter molecule by the side of the **n3d3 and first [of said liquid crystal matter layer / said] fields is set to theta 4, a product with the thickness d3 of the film to constitute theta1-theta4 satisfy the following type A1 or A2. **n1d1, **n2d2, and **n3d3 and following type A3 {theta1=+40 degree-+80 degree to satisfy, theta -- 2= +80 degrees - +150 degrees theta 3= +30 degrees - +90 degrees and theta -- 4= +100 degrees - +160 degrees --} ... A1 -- {-- theta -- 1= +40 degrees - +80 degrees theta 2= +130 degrees - +190 degrees theta 3= 0 degree - +60 degrees and theta -- 4= 0-+60 degrees --} ... A2{**n -- 1d 1= 100-300nm **n2d2=100-200nm and **n3d3=200-350nm} ... The A3 aforementioned reflective mold liquid crystal display component is offered.
[0013]
[Embodiment of the Invention] The reflective mold liquid crystal display component of this invention is equipped with a polarizing plate, a compensation component, a liquid crystal cell, and a reflecting plate.
[0014] Especially as said liquid crystal cell, it is not limited but the thing containing two or more substrates and the liquid crystal matter layer arranged in the meantime can be used. Although any liquid crystal cell using the birefringence effectiveness, such as TN orientation, STN orientation, homogeneous orientation, a homeotropic orientation, bend orientation, and HAN orientation, as said liquid crystal cell can be used, since an angle-of-visibility dependency is cancelable good in the case of the liquid crystal cell in TN mode in which it has TN orientation or HAN orientation especially, or HAN mode, these modes can be mentioned as the desirable mode.
[0015] What is depended on various kinds of drive methods, such as an active matrix using the TFT (Thin Film Transistor) electrode which uses a passive matrix and an active element as an electrode, an MIM (Metal Insulator Metal) electrode, or a TFD (Thin Film Diode) electrode, as said liquid crystal cell is mentioned.
[0016] Said polarizing plate can be arranged only to one field side of said liquid crystal cell. It can also prepare directly on one field on said liquid crystal cell, and, specifically, can also prepare through other configuration members, such as a compensation component.
[0017] Although various kinds of general things which are not limited especially as said polarizing plate,

but have an absorption shaft can be used, it is desirable to use a polarizing plate with high permeability for obtaining the high reflective mold liquid crystal display component of a reflection factor. what specifically inserted into other support films the polyvinyl alcohol film which dyed the iodine molecule with high degree of polarization the polyvinyl alcohol film extended by one shaft by the halogen polarization film which it comes to arrange in the fixed direction, or direct dye as such a polarizing plate -- high -- it can be used as a permeability polarizing plate.

[0018] Said reflecting plate can be arranged to the field of the opposite side with the field where the polarizing plate of said liquid crystal matter layer is arranged. As said reflecting plate, aluminum, silver, etc. can be used and the thing in which reflecting layers, such as aluminum and silver, were formed on substrate glass can be used with a vacuum deposition method etc.

[0019] The reflective mold liquid crystal display of this invention is equipped with the compensation component containing the liquid crystallinity film which fixed the nematic hybrid orientation whose average tilt angle is 5 degrees - 35 degrees at least as said compensation component.

[0020] The liquid crystal matter molecule is carrying out nematic orientation of the nematic hybrid orientation as used in the field of [here] this invention, and the orientation gestalt from which the angle which the director of the liquid crystal matter molecule at this time and a film flat surface make differed on the film top face and the inferior surface of tongue is said. Therefore, it is the orientation gestalt from which the include angle of this director and a film flat surface to accomplish differs near the inferior-surface-of-tongue interface near the top-face interface, and, specifically, that from which this include angle changed continuously between the top face of this film and the inferior surface of tongue can be mentioned.

[0021] The liquid crystallinity film which fixed nematic hybrid orientation is a film made into the condition that the liquid crystal matter which presented the aforementioned nematic hybrid orientation holds the orientation concerned under the condition for which a reflective mold liquid crystal display component is used, and the engine performance as a compensation component is not lost. In the liquid crystallinity film which fixed such nematic hybrid orientation, the include angle from which the director of a liquid crystal matter molecule differs in all the locations of the direction of thickness of a film is turned to. Therefore, when the film concerned is seen as the structure called a film, an optical axis does not exist.

[0022] Moreover, the average tilt angle as used in the field of this invention means the average of the include angle of the director of a liquid crystal matter molecule and film flat surface in the direction of thickness of a liquid crystallinity film to accomplish. With the liquid crystallinity film which fixed said nematic hybrid orientation, the include angle of a director and a film flat surface to accomplish should usually accomplish preferably 60 degrees - 90 degrees of 0 degree - 50 degrees of include angles of 0 degree - 30 degrees for the include angle of 80 degrees - 90 degrees as an absolute value in the field opposite to nothing and the field concerned as an absolute value near [one] the interface of a film. The range of the average tilt angle is 5 degrees - 35 degrees as an absolute value, and it can be most preferably made into 13 degrees - 27 degrees 10 degrees - 30 degrees still more preferably 7 degrees - 33 degrees. The fall of contrast etc. is caused when it separates from the range whose average tilt angle is 5 degrees - 35 degrees. In addition, an average tilt angle can apply and search for the crystal rotation method.

[0023] if the liquid crystallinity film which fixed said nematic hybrid orientation is what the above nematic hybrid orientation conditions are fixed, and has a specific average tilt angle -- how -- it may be formed from the liquid crystal matter [like]. For example, the liquid crystallinity film obtained by fixing the low-molecular-liquid-crystal matter in a liquid crystal condition according to the optical bridge formation after forming in nematic hybrid orientation, or heat bridge formation, and the liquid crystallinity film obtained by fixing the orientation concerned by cooling the liquid crystal polymer matter after forming in nematic hybrid orientation in a liquid crystal condition can be used. In addition, the liquid crystallinity film as used in the field of this invention does not ask whether the film itself presents liquid crystallinity, and contains what is obtained by film-izing liquid crystal matter, such as low-molecular-liquid-crystal matter and polymer liquid crystal matter.

[0024] Moreover, in order that the liquid crystallinity film which fixed said nematic hybrid orientation may discover a more suitable compensation effect to a reflective mold liquid crystal display component, although the thickness of this film does not generally have ****** since it is dependent on target method and various optical parameters of a liquid crystal display component, it can 0.2 micrometers - 10 micrometers usually be especially made into the range of 0.5 micrometers - 2 micrometers preferably 0.3 micrometers - 5 micrometers. When thickness is less than 0.2 micrometers, since there is a possibility that sufficient compensation effect may not be acquired, it is not desirable. Moreover, since there is a possibility that the display of a display may color superfluously when thickness exceeds 10 micrometers,

it is not desirable.

[0025] moreover, as a retardation value of the appearance within the field at the time of seeing from [of a liquid crystallinity film] a normal With the film which carried out nematic hybrid orientation The refractive index (it calls Following ne) of a direction parallel to a director differs from the refractive index (it calls Following no) of a perpendicular direction, and when the value which lengthened no from ne is seen and it considers as the upper rate of a birefringence, the retardation value on appearance is absolutely given by the product with thickness with the rate of a birefringence on appearance. The retardation value on this appearance can be easily calculated by polarization optical measurement, such as ellipsometry. the retardation value on the appearance of the liquid crystallinity film used as a compensation component -- the 550nm homogeneous light -- receiving -- usually -- 10nm - 30nm - 400nm 600nm can be especially made into the range of 50nm - 300nm preferably. When an apparent retardation value is less than 10nm, since there is a possibility that sufficient angle-of-visibility expansion effectiveness may not be acquired, it is not desirable. Moreover, when larger than 600nm, since there is a possibility that coloring unnecessary for a liquid crystal display may arise when it sees from across, it is not desirable.

[0026] Especially if the arrangement location of the compensation component containing the liquid crystallinity film which fixed said specific nematic hybrid orientation is between said polarizing plates and said reflecting plates, it will not be limited, but it can arrange the liquid crystallinity film of one sheet or two or more sheets as a compensation component that what is necessary is just one side or the both sides of said liquid crystal cell. It is desirable practically to perform angle-of-visibility compensation in this invention using the compensation component of one sheet or two sheets. Even if it uses the liquid crystallinity film of three or more sheets, although it is possible, since angle-of-visibility compensation leads to a cost rise, it is not desirable.

[0027] In addition to the compensation component containing said polarizing plate and the liquid crystallinity film which fixed said specific nematic hybrid orientation, said liquid crystal cell, and said reflecting plate, the reflective mold liquid crystal display component of this invention can also be equipped with the compensation component containing oriented films, such as a macromolecule oriented film.

[0028] As said macromolecule oriented film, oriented films, such as the polymeric material which shows optically uniaxial or optically biaxial, for example, a polycarbonate, (PC), polymethacrylate (PMMA), and polyvinyl alcohol (PVA), can be used. When using the compensation component containing said oriented film, said oriented film [one liquid crystallinity film and one macromolecule oriented film] combination is usually desirable practically. Moreover, in the reflective mold liquid crystal display component of this invention, optical films, such as for example, a phase contrast film, etc. can also be further arranged in addition to an oriented film.

[0029] Although the concrete arrangement conditions of the compensation component in the reflective mold liquid crystal display component of this invention are explained, in explaining more concrete arrangement conditions, the field of the compensation component containing a liquid crystallinity film, the direction of a tilt of this compensation component, and the direction of a pre tilt of a liquid crystal cell are defined below, respectively.

[0030] If the include angle of a liquid crystal matter part remaining cartridge REKUTA and a film flat surface to accomplish defines the field of the compensation component which contains a liquid crystallinity film first, respectively, [/ near the film interface of the liquid crystallinity film which constitutes this compensation component] The field of the way that the absolute value of the include angle of the director of a liquid crystal matter molecule and a film flat surface to accomplish is large (usually 60 - 90 degrees) is made into the b-th page, and the field of the way that this include angle is small (usually 0 - 50 degrees) is made into the c-th page as shown in drawing 5 .

[0031] When the c-th page is seen through a liquid crystallinity film layer from the b-th page of this compensation component, the direction parallel to a projection component which is a direction where the include angle which the projection component to the c-th page of liquid crystal matter part remaining cartridge REKUTA and a director accomplishes serves as an acute angle is defined as the direction of a tilt of a compensation component. Drawing 5 shows the cross section of a liquid crystallinity film roughly. In drawing 5 , the liquid crystal matter molecule is carrying out orientation in the direction parallel to a drawing, and the direction of a tilt is parallel to a drawing, and is the direction of the left from the right of a drawing.

[0032] Subsequently, by the interface of the substrate and the liquid crystal matter for a drive in a liquid crystal cell, although the liquid crystal matter leans with a certain include angle rather than is parallel and generally says this as a pre tilt angle to a cel interface, the direction parallel to the projection

component of a director which is a direction whose include angle which the projection component to the interface of the director of the liquid crystal matter molecule of a cel interface and a director makes is an acute angle is usually defined as the direction of a pre tilt of a liquid crystal cell. Drawing 6 shows roughly the cross section of the liquid crystal cell of 0 degree of twist angles, in order to illustrate the direction of a pre tilt. In drawing 6 , the liquid crystal matter molecule is carrying out orientation in the direction parallel to a drawing, the direction of a pre tilt is parallel to a drawing in the interface of the drawing bottom, it is the direction of the right from Hidari of a drawing, the direction of a pre tilt is parallel to a drawing in the interface of a drawing top, and it has become the direction of the left from the right of a drawing.

[0033] In the reflective mold liquid crystal display component of this invention, said liquid crystal cell can usually be arranged between said polarizing plates and said reflecting plates. Moreover, although this compensation component is arranged between a polarizing plate and a reflecting plate when arranging one compensation component containing said liquid crystallinity film in the reflective mold liquid crystal display component of this invention, a polarizing plate [of said liquid crystal cell] or reflecting plate side may also be arranged to whichever, and is arranged in consideration of the include angle with the direction of a pre tilt of the substrate of a liquid crystal cell with which the compensation component does not adjoin the direction of a tilt of said compensation component to accomplish.

[0034] When one compensation component which contains a liquid crystallinity film in the polarizing plate side of a liquid crystal cell is arranged, The include angle of the direction of a tilt of a compensation component, and the direction of a pre tilt by the side of the reflecting plate of a liquid crystal cell to accomplish Profile coincidence, As an absolute value, usually specifically 0 to 10 degrees preferably 0 to 15 degrees [whether it considers as the range of 0 - 5 times still more preferably, and] a profile -- 170-180, and preferably whether it considers as the range of 175 - 180 degrees still more preferably 165 to 180 degrees usually as an absolute value conversely in parallel and specifically Or it is specifically preferably desirable 80 to 100 degrees as an absolute value a profile perpendicular and to arrange so that it may become the range of 85 - 95 degrees still more preferably 75 to 105 degrees. When the include angle of the direction of a tilt of a compensation component and the direction of a pre tilt of a liquid crystal cell containing a liquid crystallinity film to accomplish is in the range which is 15 - 75 degrees, and 105 - 165 degrees, since there is a possibility that sufficient angle-of-visibility amelioration effectiveness may not be acquired, it is not desirable.

[0035] Moreover, in case two compensation components are arranged in a reflective mold liquid crystal display component, one each or arranging two sheets at a time turn on a polarizing plate [of a liquid crystal cell], and/or reflecting plate side. Moreover, even if the compensation component to be used is a compensation component which has the same parameter, the compensation component which has a different parameter is sufficient as it. When arranging one compensation component of two sheets on both sides of a liquid crystal cell, respectively, as the arrangement condition, the conditions at the time of the above-mentioned arranging one sheet can be applied to each compensation component. Namely, the direction of a tilt of each liquid crystallinity film and a liquid crystal cell, The include angle of a liquid crystallinity film and the direction of a pre tilt on the field of the opposite side to accomplish Profile coincidence, As an absolute value, usually specifically 0 to 10 degrees preferably 0 to 15 degrees [whether it considers as the range of 0 - 5 times still more preferably, and] a profile -- 170-180, and preferably whether it considers as the range of 175 - 180 degrees still more preferably 165 to 180 degrees usually as an absolute value conversely in parallel and specifically Or a profile perpendicular and the reflective mold liquid crystal display component by which angle-of-visibility amelioration was carried out by arranging so that it may become the range of 85 - 95 degrees still more preferably 80 to 100 degrees can specifically be. preferably obtained 75 to 105 degrees as an absolute value.

[0036] Moreover, when arranging the compensation component of two sheets to either the polarizing plate side of a liquid crystal cell, or a reflecting plate side, the compensation component of the side near a liquid crystal cell can be arranged like the conditions at the time of arranging an one-sheet compensation component. The include angle of the direction of a tilt of a liquid crystallinity film, and the direction of a pre tilt on the field of the liquid crystallinity film and the opposite side of a liquid crystal cell to accomplish Namely, profile coincidence, As an absolute value, usually specifically 0 to 10 degrees preferably 0 to 15 degrees [whether it considers as the range of 0 - 5 times still more preferably, and] a profile -- 170-180, and preferably whether it considers as the range of 175 - 180 degrees still more preferably 165 to 180 degrees usually as an absolute value conversely in parallel and specifically Or as an absolute value, 75 to 105 degrees, a profile perpendicular and a concrete target can arrange 80 to 100 degrees preferably so that it may become the range of 85 - 95 degrees still more preferably. The compensation component of the 2nd sheet, i.e., the compensation component of a side far from a liquid

crystal cell The include angle of the direction of a pre tilt on the field by the side of the compensation component of a liquid crystal cell and the direction of a tilt of the liquid crystallinity film of the 2nd sheet to accomplish Profile coincidence, As an absolute value, usually specifically 0 to 10 degrees preferably 0 to 15 degrees [whether it considers as the range of 0 - 5 times still more preferably, and] a profile -- 170-180, and preferably whether it considers as the range of 175 - 180 degrees still more preferably 165 to 180 degrees usually as an absolute value conversely in parallel and specifically Or a profile perpendicular and the reflective mold liquid crystal display component by which angle-of-visibility amelioration was carried out by arranging so that it may become the range of 85 - 95 degrees still more preferably 80 to 100 degrees can specifically be preferably obtained 75 to 105 degrees as an absolute value.

[0037] At a time the compensation component which contains at least two sheets or a liquid crystallinity film for the compensation component containing a liquid crystallinity film, and at least one compensation component containing an oriented film Moreover, the polarizing plate side of a liquid crystal cell, Namely, when arranging between a polarizing plate and a liquid crystal cell, In the liquid crystal matter layer in said liquid crystal cell A liquid crystal matter molecule angle of torsion accomplished toward the second field of the opposite side from the first field by the side of said compensation component theta 1, The product of refractive-index anisotropy **n1 of said liquid crystal matter molecule, and the thickness d1 of said liquid crystal matter layer among said compensation components of two sheets from the orientation shaft of said liquid crystal matter molecule by the side of the first [of **n1d1 and said liquid crystal matter layer / said] field the include angle to the lagging axis of the compensation component A of the direction near said liquid crystal cell theta 2, refractive-index anisotropy **n2 of said compensation component A, and said compensation component A A product with the thickness d2 of the film to constitute The include angle to the lagging axis of the compensation component B of the one distant from said liquid crystal cell among said compensation components of two sheets from the orientation shaft of said liquid crystal matter molecule by the side of the first [of **n2d2 and said liquid crystal matter layer / said] field theta 3, refractive-index anisotropy **n3 of said compensation component B, and said compensation component B If the include angle from an orientation shaft to the absorption shaft of said polarizing plate of said liquid crystal matter molecule by the side of the **n3d3 and first [of said liquid crystal matter layer / said] fields is set to theta 4, a product with the thickness d3 of the film to constitute Especially the thing with which theta1-theta4 are satisfied with of the following type A1 or A2, and **n1d1, **n2d2, and **n3d3 are satisfied of following type A3 is desirable.

{theta -- 1= +40 degrees - +80 degrees theta 2= +80 degrees - +150 degrees theta -- 3= +30 degrees - +90 degrees and theta4=+100degree-+160degree} ... A1 -- {-- theta -- 1= +40 degrees - +80 degrees theta 2= +130 degrees - +190 degrees theta 3= 0 degree - +60 degrees and theta -- 4= 0-+60 degrees --} ... A2{**n -- 1d 1= 100-300nm **n2d2=100-200nm and **n3d3=200-350nm} ... If theta1-theta4 in A3 A1 or A2 separate from the above-mentioned range, since there is a possibility that the fall of contrast and increase of coloring, or its either may happen, it is not desirable. In addition, in this specification, although the hand of cut of a relative include angle is meant as the direction of + of an include angle, and the direction of -, +, then a clockwise rotation become - from a polarizing plate about a counterclockwise rotation toward a reflecting plate and +, then the direction of a counterclockwise rotation become - about a clockwise rotation conversely, also when which is made into +, it is included by the range of this invention and equivalent effectiveness can be acquired. Moreover, when not satisfying A3, since there is a possibility that problems, such as a fall of contrast and increase of coloring, may arise, it is not desirable.

[0038] Moreover, when arranging combining the compensation component which consists of an oriented film besides a liquid crystallinity film as a compensation component, an oriented film may be arranged to whichever of the b-th page or the c-th page of a liquid crystallinity film, and can also arrange two oriented films to both sides of a liquid crystallinity film. Since the liquid crystallinity film used for this invention here forms nematic hybrid orientation, a liquid crystallinity film is vertical asymmetry. Therefore, in the case where an oriented film is arranged to a case [where it arranges to the b-th page side of a liquid crystallinity film], and c-th page side, the reflective mold liquid crystal display which has angle-of-visibility amelioration effectiveness which the optical implications naturally differ and is different to which it actually arranges can be obtained. Moreover, in order to obtain desired optical-character ability, the oriented film of two or more sheets can also be distributed and arranged to either or both by the side of the b-th page or the c-th page. Anyway, about the arrangement relation of both the compensation component in the case of arranging for the reflective mold liquid crystal display component of this invention combining the compensation component containing an oriented film, and the compensation component containing a liquid crystallinity film, it can consider as a desirable component by optimizing in consideration of an optical parameter, optical-character ability demanded of a liquid crystal cell.

[0039] The reflective mold liquid crystal display component of this invention can perform a bright achromatic color display by arranging a compensation component on the above conditions, and its contrast is high, and an angle-of-visibility dependency is canceled. Moreover, the reflective mold liquid crystal display component of this invention may be equipped with other components other than the polarizing plate which it has as an indispensable component, a compensation component, a liquid crystal cell, and a reflecting plate. The various optical members which specifically have properties, such as optical diffusion for raising a display property and optical diffraction, are combinable. It will not be limited especially if it has the property to diffuse incident light isotropic or in different direction, as an optical member which has optical diffusibility. Moreover, it will not be limited especially if it has the property to make incident light diffract isotropic or in different direction also as an optical member which has optical diffraction. By furthermore having a color filter etc., it can consider as the color reflective mold liquid crystal display component which can perform multicolor or a full color display with high color purity.

[0040]

[Effect of the Invention] An angle-of-visibility property is improved, and the reflective mold liquid crystal display of this invention cannot fall, but can use a contrast property etc. as the reflective mold liquid crystal display which is very excellent in visibility.

[0041]

[Example] Although an example explains this invention further below at a detail, this invention is not limited to these.

(Example 1 of manufacture) 6-hydroxy-2-naphthoic acid 100mmol, terephthalic acid 100mmol, chlorohydroquinone 50mmol, tert-butyl catechol 50mmol and acetic anhydride 600mmol was taken, it performed at 280 degrees C and 140 degrees C performed [for 2 hours] the polymerization reaction at 300 degrees C by 270 degrees C under nitrogen-gas-atmosphere mind for 2 hours for 2 hours for 2 hours.

[0042] After dissolving the obtained reactant living thing in tetrachloroethane, as a result of a methanol's reprecipitating and refining, liquid crystallinity polyester was obtained. the logarithm of the obtained liquid crystallinity polyester -- viscosity is 0.15 (it is an Ubbelohde viscometer and measures at 30 degrees C among a phenol / tetrachloroethane (60/40-fold quantitative ratio) mixed solvent), it had a nematic phase as a liquid crystal phase as a result of DSC measurement and polarization microscope observation, and it became clear that isotropic phase-liquid crystal phase transition temperature was 300 degrees C or more, and a glass transition point was 135 degrees C.

[0043] 5% of the weight of the tetrachloroethane solution of this liquid crystallinity polyester was prepared, and this solution was applied to the glass substrate which has the rubbing polyimide film with the spin coat method.

[0044] After drying a solvent, by heat-treating for 30 minutes and cooling at 250 degrees C, it was transparent and the film without an orientation defect was obtained on the glass substrate.

[0045] When polarization analysis of the obtained film was carried out, it became clear that the nematic hybrid orientation whose average tilt angle in the direction of thickness is 25 degrees was formed. Moreover, the real thickness of a film was 0.77 micrometers.

(Example 1) The reflective mold liquid crystal display component which has the configuration shown in drawing 7 and drawing 8 was created.

[0046] As a compensation component, the liquid crystallinity film (5 6) manufactured in the example 1 of manufacture was used.

[0047] As a liquid crystal cell 2, it has the layer of ZLI-1695 as a liquid crystal matter layer, and the cel parameter used the thing of cel gap 3.5micrometer, 63 angle of torsion (left hand), and two pre tilt angles.

[0048] Each liquid crystallinity film (5 6) has been arranged between a liquid crystal cell 2 and a polarizing plate 1 so that it may become a side with the air interface side (side which faced the air interface at the time of preparation) near a polarizing plate. Moreover, driver voltage was impressed to the electrode of the upper and lower sides of a liquid crystal cell 2 from the drive circuit which omitted illustration.

[0049] In drawing 7, although each component was typically shown in the condition of having dissociated, these components were stuck through adhesives in fact. Moreover, in drawing 7, the top and reflecting plate side is illustrated for the polarizing plate side as the bottom.

[0050] In drawing 8, the direction of the lagging axis of 22 and the liquid crystallinity film 5 is illustrated for the direction of orientation of the liquid crystal matter molecule on the field by the side of 21 and a reflecting plate, and 61 and the absorption shaft orientations of a polarizing plate are illustrated [the direction of orientation of the liquid crystal matter molecule on the field by the side of the polarizing plate of a liquid crystal cell 2 seen from the polarizing plate side of a reflective mold liquid crystal display

component] for the direction of the lagging axis of 51 and the liquid crystallinity film 6 as 11.
[0051] The product deltan1 of the refractive-index anisotropy deltan1 of a liquid crystal cell 2 and the thickness d1 of a liquid crystal matter layer and d1 were set to about 210nm, the product deltan2 of the refractive-index anisotropy deltan2 of the liquid crystallinity film 5 and thickness d2 and d2 were set to 140nm, and the product deltan3 of the refractive-index anisotropy deltan3 of the liquid crystallinity film 6 and thickness d3 and d3 were set to 280nm. and The angle of torsion theta 1 of the counterclockwise rotation of the liquid crystal matter molecule from [said / 21] orientation to the direction 22 of orientation, the include angle theta 2 of the counterclockwise rotation from [said / 21] orientation to said direction 51 of a lagging axis, the include angle theta 3 of the counterclockwise rotation from [said / 21] orientation to said direction 61 of a lagging axis, And the include angle theta 4 of the counterclockwise rotation from [said / 21] the orientation to said absorption shaft orientations 11 has been arranged with theta1=+63 degree, theta2=+153 degree, theta3=+33 degree, and theta4=+43 degree, respectively.
[0052] The reflection factor to the applied voltage of the created reflective mold liquid crystal display component was measured. A result is shown in drawing 9 .
[0053] The chromaticity change to the applied voltage of the created reflective mold liquid crystal display component was measured. A result is shown in drawing 10 as a CIE chromaticity diagram.
[0054] the created reflective mold liquid crystal display component -- white -- the ratio (white display) of the permeability at the time of impressing display 0V and black display 6V -- the contrast ratio from an omnidirection was measured by making / (black display) into a contrast ratio. A result is shown in drawing 11 .
(Example 2) The reflective mold liquid crystal display component which has the configuration shown in drawing 7 and drawing 8 like an example 1 was created. However, the liquid crystallinity film which is 1.27 micrometers of thickness by which the nematic hybrid orientation whose average tilt angle of the direction of thickness is 15 degrees was fixed as a liquid crystallinity film 6 was used using the liquid crystallinity film which is 0.66 micrometers of thickness by which the nematic hybrid orientation whose average tilt angle of the direction of thickness is 15 degrees was fixed as a liquid crystallinity film 5. Moreover, the product deltan3 of the refractive-index anisotropy deltan3 of 140nm and the liquid crystallinity film 6 and thickness d3 and d3 were set [the product deltan1 of the refractive-index anisotropy deltan1 of a liquid crystal cell 2, and thickness d1, and d1] to 270nm for the product deltan2 of the refractive-index anisotropy deltan2 of 210nm and the liquid crystallinity film 5, and thickness d2, and d2. Furthermore, it has arranged with theta1=+63 degree, theta2=+163 degree, theta3=+28 degree, and theta4=+38 degree.
[0055] About the created reflective mold liquid crystal display component, the contrast ratio from an omnidirection was measured like the example 1 in the reflection factor and chromaticity change list to applied voltage. A result is shown in drawing 12 -14, respectively.
(Example 3) The reflective mold liquid crystal display component which has the configuration shown in drawing 7 and drawing 8 like an example 1 was created. However, the 1 shaft extension PC (polycarbonate) film 5 was used instead of the liquid crystallinity film 5. Moreover, the liquid crystallinity film which is 1.27 micrometers of thickness by which the nematic hybrid orientation whose average tilt angle of the direction of thickness is 15 degrees was fixed as a liquid crystal film 6 was used. The product deltan1 of the refractive-index anisotropy deltan1 of a liquid crystal cell 2, and thickness d1, and d1 Furthermore, 210nm, The product deltan2 of the refractive-index anisotropy deltan2 of the uniaxial-stretching PC film 5, and thickness d2, and d2 140nm, The product deltan3 of the refractive-index anisotropy deltan3 of the liquid crystallinity film 6 and thickness d3 and d3 were set to 270nm, and it has arranged with theta1=+63 degree, theta2=+163 degree, theta3=+43 degree, and theta4=+53 degree.
[0056] About the created reflective mold liquid crystal display component, the contrast ratio from an omnidirection was measured like the example 1 in the reflection factor and chromaticity change list to applied voltage. A result is shown in drawing 15 -17, respectively.
(Example 1 of a comparison) The reflective mold liquid crystal display component which has the configuration shown in drawing 7 and drawing 8 like an example 1 was created. However, not using the liquid crystallinity film, two 1 shaft extension polyvinyl alcohol (PVA) films were used instead. The product deltan1 of the refractive-index anisotropy deltan1 of a liquid crystal cell 2, and thickness d1, and d1 Moreover, 210nm, The product deltan2 of the refractive-index anisotropy deltan2 of the 1 shaft extension PVA film 5, and thickness d2, and d2 140nm, The product deltan3 of the refractive-index anisotropy deltan3 of the 1 shaft extension PVA film 6 and thickness d3 and d3 were set to 260nm, and it has arranged with theta1=+63 degree, theta2=+3 degree, theta3=+118 degree, and theta4=+13 degree.
[0057] About the created reflective mold liquid crystal display component, the contrast ratio from an

omnidirection was measured like the example 1 in the reflection factor and chromaticity change list to applied voltage. A result is shown in drawing 18 -20, respectively.
(Example 2 of a comparison) The reflective mold liquid crystal display component which has the configuration shown in drawing 7 and drawing 8 like an example 1 was created. However, not using the liquid crystallinity film, the principal indices of refraction nx, ny, and nz used instead two biaxial extension polyvinyl alcohol (PVA) films which fill the relation between nz= (nx+ny) / 2. The product deltan1 of the refractive-index anisotropy deltan1 of a liquid crystal cell 2, and thickness d1, and d1 Moreover, 210nm, The product deltan2 of the refractive-index anisotropy deltan2 of the biaxial extension PVA film 5, and thickness d2, and d2 140nm, The product deltan3 of the refractive-index anisotropy deltan3 of the biaxial extension PVA film 6 and thickness d3 and d3 have been arranged with 260nm theta 1= +63 degrees theta 2= +3 degrees theta 3= +118 degrees theta 4= +13 degrees.
[0058] About the created reflective mold liquid crystal display component, the contrast ratio from an omnidirection was measured like the example 1. A result is shown in drawing 21 .
[0059] It turns out that the angle of visibility which looked at examples 1, 2, and 3 from the contrast in monochrome display compared with the examples 1 and 2 of a comparison is improved sharply so that clearly from drawing 11 , drawing 14 , drawing 17 , drawing 20 , and drawing 21 .

[Brief Description of the Drawings]
[Drawing 1] It is a schematic diagram for explaining the tilt angle and twist angle of a liquid crystal molecule.
[Drawing 2] It is a schematic diagram for explaining the conventional TN mode.
[Drawing 3] It is a schematic diagram for explaining the combination of the conventional TN mode and a quadrant wavelength plate.
[Drawing 4] It is a schematic diagram for explaining the angle-of-visibility dependency in the conventional TN mode.
[Drawing 5] It is the schematic diagram of the oriented structure of the liquid crystallinity film which constitutes a compensation component.
[Drawing 6] It is the schematic diagram of the oriented structure of a liquid crystal cell.
[Drawing 7] It is the perspective view which expressed typically the reflective mold liquid crystal display of this invention created in examples 1-3.
[Drawing 8] It is the top view having shown the angular relation-ship with the absorption shaft of the polarizing plate in the reflective mold liquid crystal display of this invention created in examples 1-3, the direction of orientation of a liquid crystal cell, and the direction of a lagging axis of a liquid crystallinity film in the mode seen from the polarizing plate side.
[Drawing 9] It is drawing showing the reflection factor to electrical-potential-difference change of an example 1.
[Drawing 10] It is the CIE chromaticity diagram showing change of the chromaticity to electrical-potential-difference change of an example 1.
[Drawing 11] It is drawing showing the contrast ratio when seeing the reflective mold liquid crystal display in an example 1 from an omnidirection.
[Drawing 12] It is drawing showing the reflection factor to electrical-potential-difference change of an example 2.
[Drawing 13] It is drawing showing change of the chromaticity to electrical-potential-difference change of an example 2.
[Drawing 14] It is drawing showing the contrast ratio when seeing the reflective mold liquid crystal display in an example 2 from an omnidirection.
[Drawing 15] It is drawing showing the reflection factor to electrical-potential-difference change of an example 3.
[Drawing 16] It is drawing showing change of the chromaticity to electrical-potential-difference change of an example 3.
[Drawing 17] It is drawing showing the contrast ratio when seeing the reflective mold liquid crystal display in an example 3 from an omnidirection.
[Drawing 18] It is drawing showing the reflection factor to electrical-potential-difference change of the example 1 of a comparison.
[Drawing 19] It is drawing showing change of the chromaticity to electrical-potential-difference change of the example 1 of a comparison.
[Drawing 20] It is drawing showing the contrast ratio when seeing the reflective mold liquid crystal

display in the example 1 of a comparison from an omnidirection.
[Drawing 21] It is drawing showing the contrast ratio when seeing the reflective mold liquid crystal display in the example 2 of a comparison from an omnidirection.
[Description of Notations]
1: Polarizing plate
2: Liquid crystal cell
3: Reflecting plate
1/4:4 wavelength plate
5: Liquid crystallinity film (or oriented film)
6: Liquid crystallinity film (or oriented film)
11: The absorption shaft of a polarizing plate
21: The direction of liquid crystal molecular orientation by the side of the polarizing plate of a liquid crystal cell
22: The direction of liquid crystal molecular orientation by the side of the reflecting plate of a liquid crystal cell
51: The lagging axis of a film
61: The lagging axis of a film